NERRS Science Collaborative Progress Report for the Period 10/01/12 through 2/28/13

Project Title: Exploring the cost-effectiveness of restored marshes as filters of runoff pollution in a world of rising seas.

Principal Investigator: Eric Brunden

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Report compiled by: Eric Sparks

Contributing team members and their role in the project:

Eric Brunden- Project coordinator

Mike Shelton- Local Collaboration Lead

Dr. Jessica Thompson- Collaboration Advisor

Dr. Just Cebrian- Applied Science Investigator

Dr. Julia Cherry- Applied Science Investigator

Dr. Craig Tobais- Additional Investigator

Eric Sparks- Technician

Adam Constantin- Graduate student researcher

A. Progress overview:

Non-point source nitrogen pollution is a major problem worldwide. This problem is difficult to avert and manage. With previous work we have demonstrated that marshes restored to full coverage (100% plant cover) can filter large amounts of runoff pollution. We do not know, however, the extent of runoff removal by marshes restored to lower levels of coverage as the marshes fill in and increase their coverage. This information is important to devise cost-effective management strategies for reducing runoff pollution through marsh restoration. Such strategies also need to consider sea level rise, as rising seas can alter fringing marshes through increased flooding and/or salinity stress, and by default their capacity to filter runoff pollution. We will conduct a series of experiments to quantify runoff pollution removal by marshes restored to varying degrees of coverage under current and future sea level scenarios. We will generate different runoff regimes, ranging from intense, short-lived rainfall to prolonged, light drizzle, and quantify nitrogen filtration (loss and retention) as the runoff plume travels through the restored marshes. With the results from the experiments we will

carry out cost-effectiveness analyses contrasting the extent of pollution removal versus the cost of marsh construction and upkeep under current and predicted tidal flooding conditions. The ultimate goal is to build a decision support tool that will help managers attain runoff reduction targets through marsh restoration in effective and affordable ways given their time and budget constraints. The decision support tool will also present adaptive strategies to maximize runoff filtration with marsh restoration under rising seas.

For this reporting period we had 2 goals, 1) meet with our Management Application Team (MAT) and 2) use their input to construct the experimental marsh sites. The MAT is group of potential end users for the decision support tool derived from this project from both government and private sectors. Our first MAT meetings occurred on Dec 10th-11th. The Dec 10th meeting was a workshop style meeting led by the collaboration leads for the project, Dr. Jessica Thompson and Mike Shelton. The primary goal of this meeting was to increase our collaboration skill set through the introduction of terminology and the concept of mediated modeling. The Dec 11th meeting was focused on the Applied Science team and MAT discussing the projects experimental design and adjusting it to make our findings more applicable to intended users (MAT). The applied science team and MAT came to a unanimous decision to use each of the experimental clusters to mimic different scenarios of runoff pollution; including light rain, heavy rain and retention ponds.

The second goal for this reporting period was to use the input derived from the MAT meetings to construct the experimental marshes. Site construction began on Jan 11th and finished on Jan 14th. After the site was constructed, the sediment was allowed ample time to acclimate to its new surroundings prior to marsh planting. On Feb 8th marsh sods were harvested from a nearby natural marsh and on Feb 9th these sods were transplanted into the experimental marsh. Many volunteers from the Dauphin Island Sea Lab, Weeks Bay NERR, The Nature Conservancy, U.S. Fish and Wildlife Service and the general public came out to help with the transplantation. The experimental marsh sites were chosen to facilitate the runoff pollution scenarios suggested by the MAT. The first two experimental clusters are located in an area of average tidal amplitude and flushing, these clusters will be used to mimic light and heavy rain scenarios. The third cluster is located in an area of less than average tidal amplitude and a low degree of tidal flushing; this cluster will be used to mimic the retention pond runoff pollution scenario.

B. Working with Intended Users:

The integration of input from intended users of this research has been integral throughout the entire process of this project. As mentioned in the previous section, we held a meeting with the MAT to ensure our experimental design was best suited to address the needs

of intended end users. The Applied Science team and MAT unanimously came to an agreement to use each of the three experimental clusters to address different scenarios of runoff pollution: light rain event, heavy rain event, and retention ponds. A Basecamp account (https://nerrssciencecollaborative.basecamphq.com/projects/10447377-weeks-bay-nerr-collaborative-basecamp/log) was also set up after the MAT meeting to facilitate streamlined communication for all involved with the project. Basecamp is basically a message board for all of the MAT members and contributing team members to share messages and photos regarding this project. Over the next 6 months, another MAT meeting is planned after the flow rate experiments and prior to the nutrient dosing experiments. In that meeting the Applied Science team will share flow rate results and details of the upcoming nutrient dosing experiment. The Applied Science team and MAT will then modify (if necessary) the experimental plan to best suit the needs of the MAT.

C. Progress on project objectives for this reporting period:

Both objectives for this reporting period were achieved and these objectives were: 1) meet with the MAT and 2) use their input to construct the experimental marsh. The MAT meeting was conducted on Dec 10th -11th and marsh construction (site construction and marsh planting) were completed on Feb 9th. See the Progress Overview section (A) for a more detailed description of the completion of project objectives timeline. In the next 6 months, we have 3 project objectives: 1) conduct a flow rate study on the experimental marsh, 2) meet with the MAT to discuss the results from the flow rate study and plans for the nutrient dosing study and 3) conduct a nutrient dosing study. A tentative schedule for meeting these project objectives is to conduct the flow rate study in March, meet with the MAT in early April and conduct the nutrient dosing study in late April or early May. Several months following the nutrient dosing study will be used to process samples and analyze results prior to another MAT meeting.

D. Benefits to NERRS and NOAA:

A direct benefit to NERRS, NOAA and the general public, for this reporting period, is the restoring of approximately 75 square meters of marshland that had been dredged out to form a canal. Crabs, birds and fish have already begun frequenting the restored marsh. Also several fishermen have been fishing by boat around the seaward edge of the marsh to catch these newly attracted fish. Another benefit is the exposure we obtain from the location of clusters 1 and 2. Both of these clusters are located near a frequently used boat launch and several of these boaters have walked up to the site to see restoration progress. This interaction between the general public and scientist at the research site is a great opportunity to educate the general public on the experiments and benefits of marshes as well as receive input as to how the public values marshes.